JET PROPULSION LABORATORY INTEROFFICE MEMORANDUM

May 19, 2003

IOM ECH0005-2003-19

TO: Eugene Burke

FROM: E. C. Hampton

SUBJECT: Space Infrared Telescope Facility (SIRTF) Launch and In-Orbit-Checkout Study

REFERENCE: Request from Patrick Beyer to perform a SIRTF DSN load study based on a planned launch day and In-Orbit-Checkout Phase occurring within the period of August 13, 2003 through February 29, 2004.

## Introduction

The Resource Allocation Planning and Scheduling Office (RAPSO) has performed a study to determine the amount of supportable time SIRTF can expect to receive for launch support occurring anytime within the period of August 13, 2003 through February 29, 2004 and to asses its impact on DSN resources. This study will also identify approved scheduled antenna downtimes and potential periods of contention with other users of the DSN resources during this period.

SIRTF launch is scheduled for August 14, 2003. However, the information presented in this study used viewperiods generated with August 13, 2003 as launch and In-Orbit-Checkout (IOC) beginning at launch plus one day and continuing for ninety days. Launch and IOC coverage is scheduled using the 34-meter Beam Waveguide 1 Subnet (34BWG1) for launch. Beginning on the first day after launch, SIRTF continuous support is schedule at each DSN subnet to determine the amount of supportable time SIRTF can expect to receive.

## Significant Events

1. Cassini Gravity Wave Experiment
2. DSS-55 becomes operational in November 2003
3. Galileo Jupiter Impact
4. Mars Express Mars Capture
5. MERA launch phase support, Mars approach, Entry Descent Landing (EDL), and Surface Ops
6. MERB launch phase support, Mars approach, EDL and Surface Ops
7. Nozomi Earth/Lunar Flyby, Mars Approach, and Orbit Insertion (MOI)
8. Rosetta Launch
9. Stardust Deep Space Maneuver and Comet P/Wild Encounter/Approach

10. Ulysses Jupiter Encounter

**Major Downtime**

1. DSS-16 Hydraulic Maintenance
2. DSS-25 20 kW X-Band installation
3. DSS-46 Heat Ventilation and Air Conditioning maintenance
4. DSS-54 20 kW X-Band uplink installation

**Objectives of the study**

1. To perform a DSN antenna loading study on the 34M and 70M Subnets using the FASTER software, SIRTF viewperiods, User Loading Profile (ULP), and for reference, the Project Service Level Agreement (PSLA).
2. To provide a forecast of the user supportable hours based on continuous support from launch on August 13, 2003 through February of 2004.
3. To identify major events and planned major antenna downtimes that will affect the network loading from August 2003 through February 2004.
4. To identify potential contention periods between SIRTF's requested support and other users of DSN resources from August 2003 through February 2004.

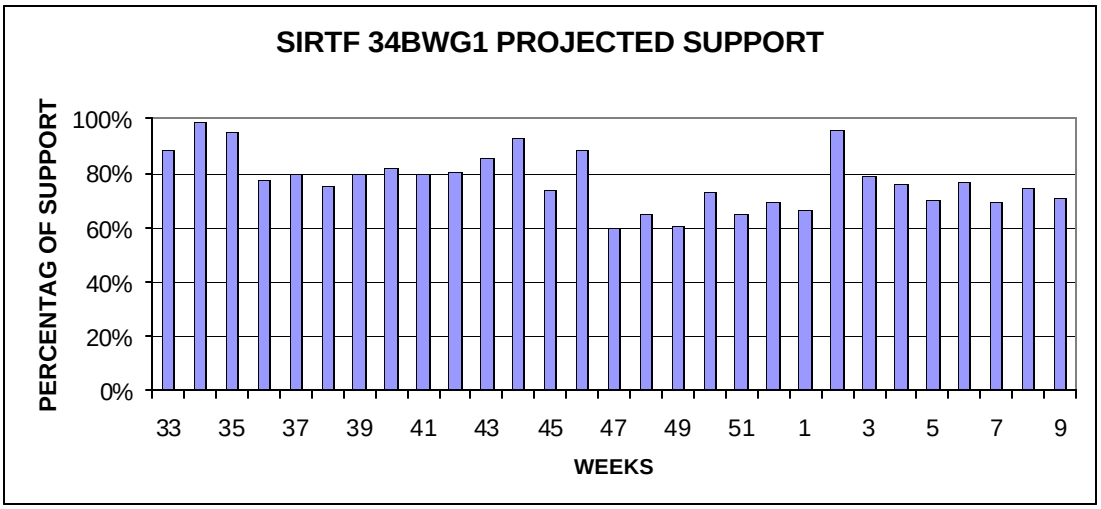
**Assumptions**

1. Launch day is August 13, 2003
2. 34BWG1 is prime for launch
3. Use of DSS-26 only for 34BWG2, DSS-65 for DSS-54 supports in weeks 33-36, and DSS-26 and 54 in week 37
4. Use of any 34-m and 70-m Subnets after launch
5. Assume scheduled antenna downtimes will be completed as planned
6. DSS-55 is operational in week 38

**DSN Support Resource Assessment**

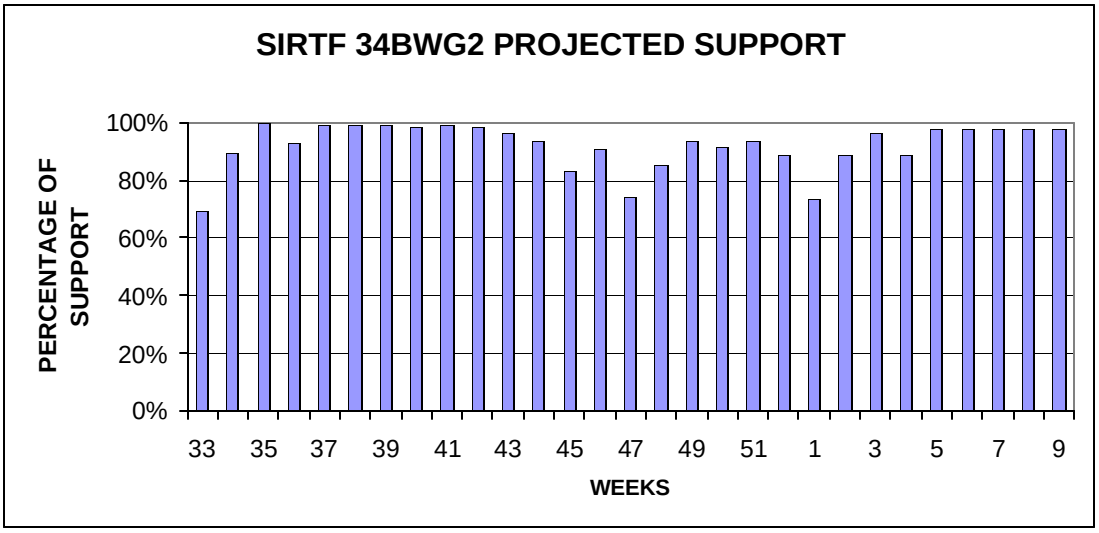
**34BWG1** SIRTF can expect to receive approximately 60 to 95 percent of their support on the 34BEG Subnet. *See Figure 1.* The 75 to 95 percent of supportable time occurs in weeks 33 through 37 and is the amount of support provided by DSS-24 and DSS-34; DSS-54 is down at this time for 20kW X-Band uplink installation. The supportable time for SIRTF fluctuates between 60 and 85 percent in weeks 38 through week 09 of 2004.

**Figure 1: SIRTF 34BWG1 PROJECTED SUPPORT**



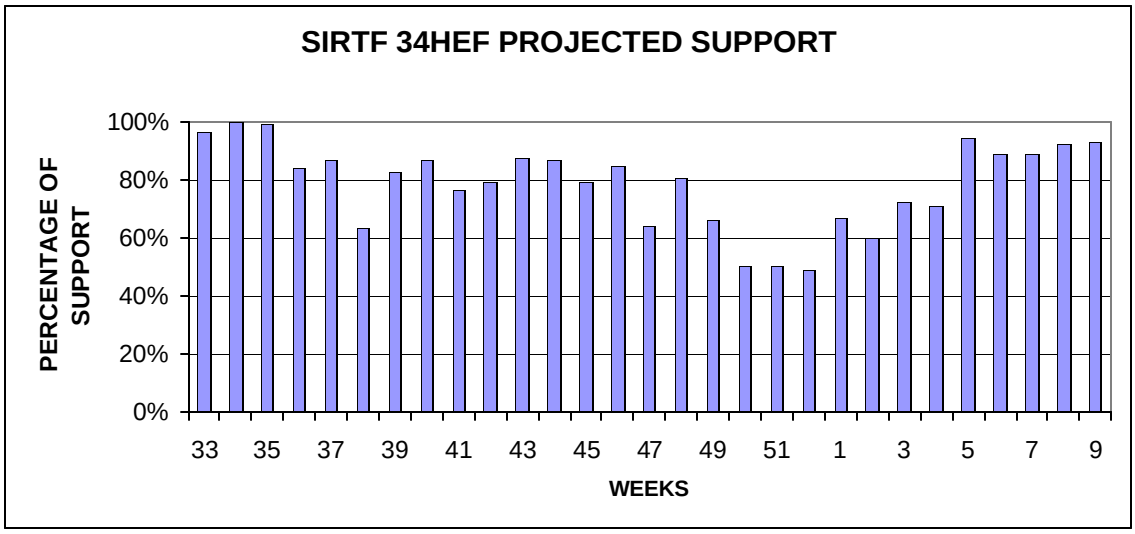

**34BWG2** The projected supportable time for SIRTF on the 34BWG2 Subnet Ranges from 65 to 100 percent. *See Figure 2*. The supportable percentage of time on the 34BWG2 in weeks 33 through 36 is provided by DSS-26. DSS-25 is down for 20kW X-Band installation through week 37 and DSS-55 is not operational at this time. In weeks 38 through week 09, the supportable percentage of time on the 34BWG2 Subnet when all antennas (DSS-25, DSS-26, and DSS-55) are available for support ranges from 65 to 100 percent. This is based on two 8-hour supports per day, since DSS-25 and DSS-26 share the same viewperiod.

**Figure 2: SIRTF 34BWG2 PROJECTED SUPPORT**



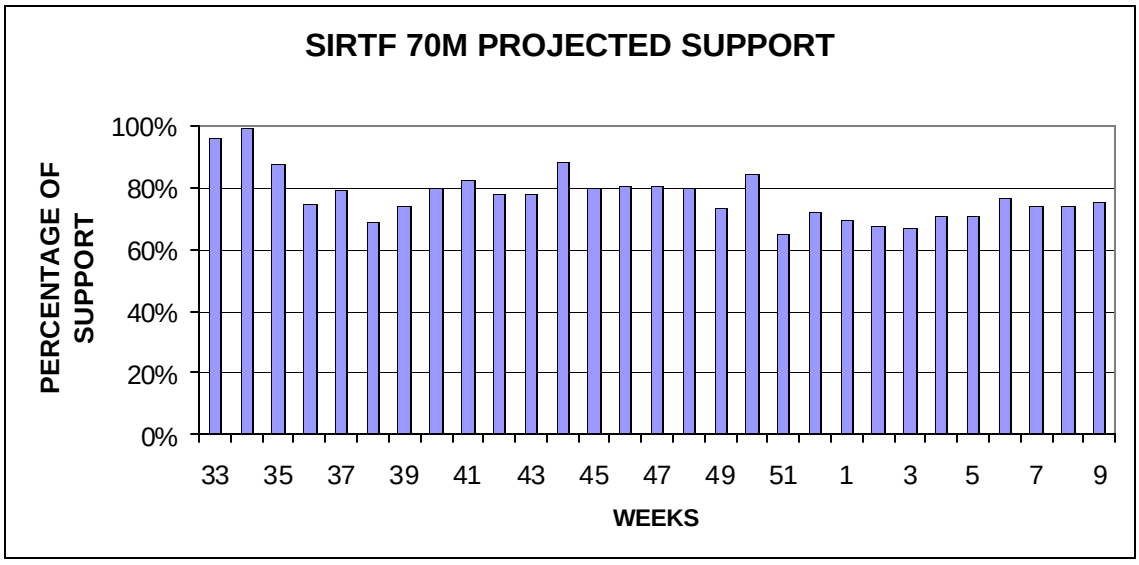
**34HEF** The projected supportable time on the 34HEF Subnet ranges from 50 to 95 percent over this time period. *See Figure 3.* All 34HEF antennas are operational as compared to the 34BWG Subnet and provide SIRTF with three 8-hour passes per day.

**Figure 3: SIRTF 34HEF PROJECTED SUPPORT**




**70M** SIRTF can expect to receive from 65 to 98 percent of their support on the 70M Subnet. *See Figure 4.* The 95 to 98 percent of supportable time occurs during the first two weeks of launch after which the supportable time begins to decrease. Throughout weeks 35 through week 09 of 2004, the supportable time fluctuate between 65 to 85 percent.

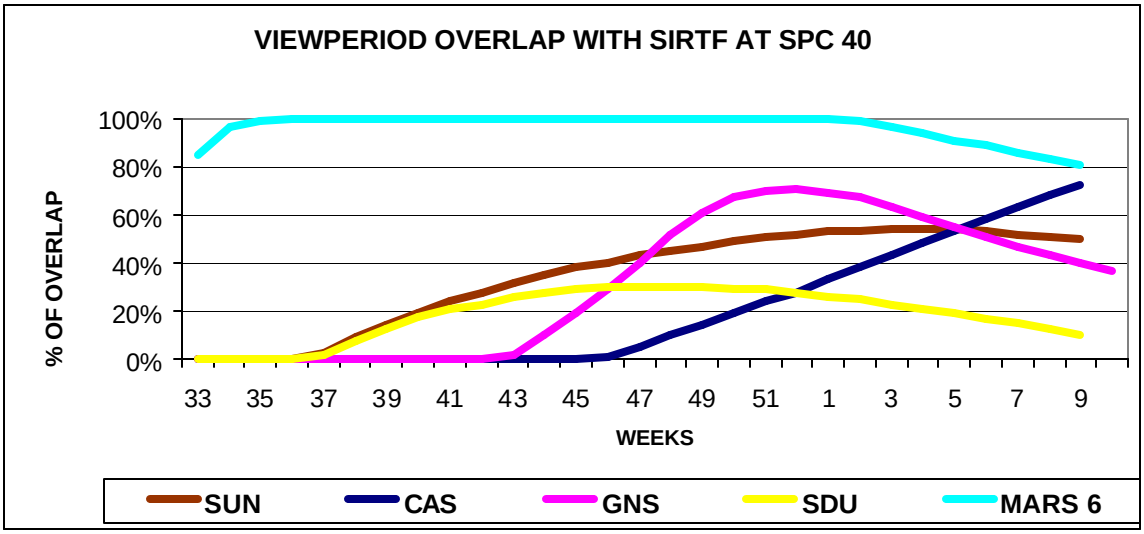
**Figure 4: SIRTF 70M PROJECTED SUPPORT**



## Project Contention

The unsupportable time for launch and IOC in weeks 33 through 47 can be attributed to the following activities scheduled during this time period: antenna downtimes, Mars Express, MERA, MERB continuing launch support phase, Nozomi's Earth and Lunar flybys, Stardust Deep Space Maneuver and Comet P/Wild Encounter, and Cassini Gravity Wave Experiment. The decrease in coverage in weeks 48 through 52 is due to the beginning of the Mars missions (all the missions approaching Mars) high activity period for Stardust, P/Wild Encounter, Mars Express Mars Capture, Nozomi, MERA and MERB Mars approach and Mars EDL tests, and Cassini GWE.

**Figure 5: VIEWPERIOD OVERLAP WITH SIRTF AT SPC 40**




In late November, most of the projects viewperiods are moving into alignment with each other. Projects sharing in the same viewperiod have a higher percentage of unsupportable time. The available hours for support at each subnet for missions sharing the same viewperiod are limited and contention is high. *See Figures* 5, *6, and 7.* Canberra has an especially difficult time supporting the Mars Missions and SIRTF during this period (~100% viewperiod overlap) and whether Parkes Radiotelescope will be of assistance is to be determined. The unsupportable time from January through February (weeks 1-9) is primarily due to viewperiod overlap with most Mars missions, Cassini, Genesis, and Stardust, MERA, MERB, and DSS maintenance. MERA and MERB are in their prime mission phase, EDL and Mars Surface operation is planned for this time frame requesting dual station coverage for EDL. Throughout this period, DSS maintenance (represented as SUN in the chart due to the need for maintenance to be primarily performed in daylight) has a 25 to 40 percent viewperiod overlap with SIRTF and will cause moderate contention with SIRTF.

**Figure 6: VIEWPERIOD OVERLAP WITH SIRTF AT SPC 10**

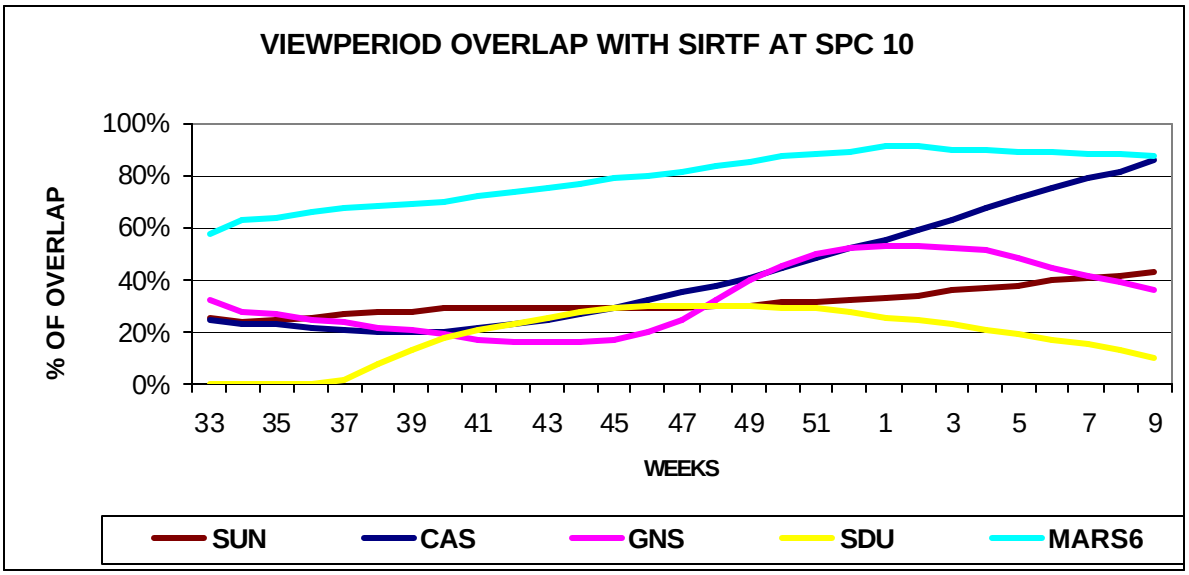
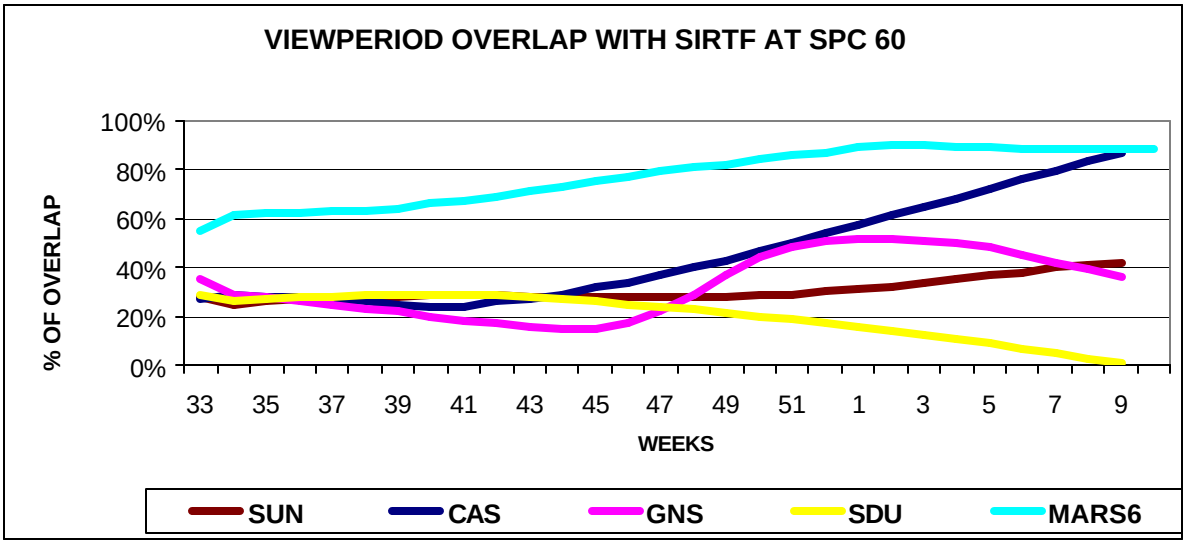



**Figure 7: VIEWPERIOD OVERLAP WITH SIRTF AT SPC 60**




SIRTF continuous support was added to the User Loading Profile for each subnet to determine the effect on other users of the DSN resources. SIRTF launch and IOC in August 2003 through February 2004 increases the weekly user unsupportable time per subnet by approximately 10 to 20 percent. *See Figure 8.* The weekly unsupportable time without SIRTF averages below 10 percent as shown in *Figure 9.*

**Figure 8: WEEKLY USER LOST PERCENTAGE BY SUBNET WITH SIRTF**

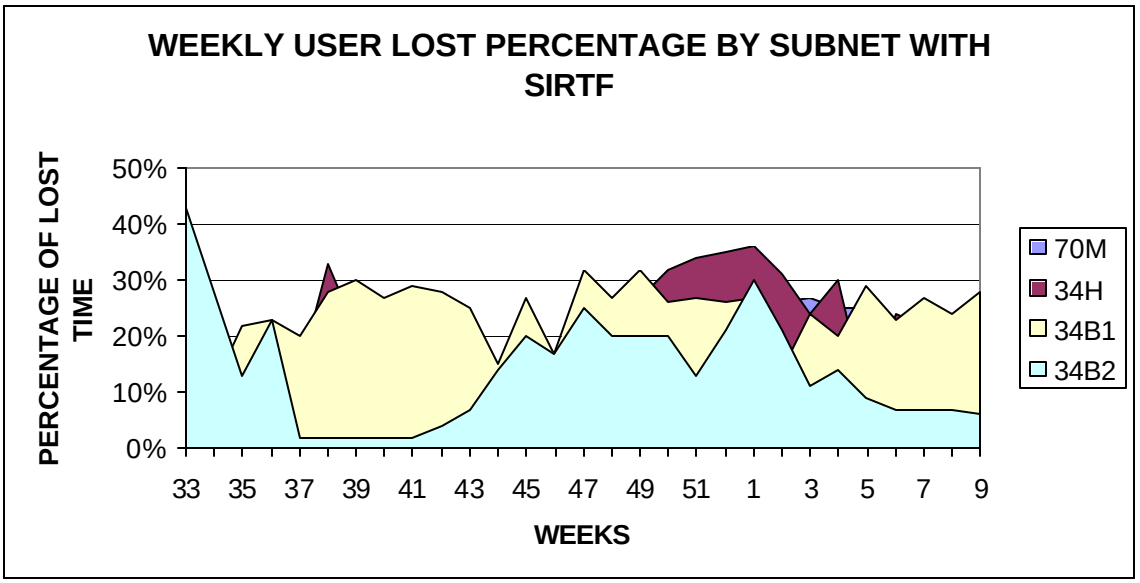
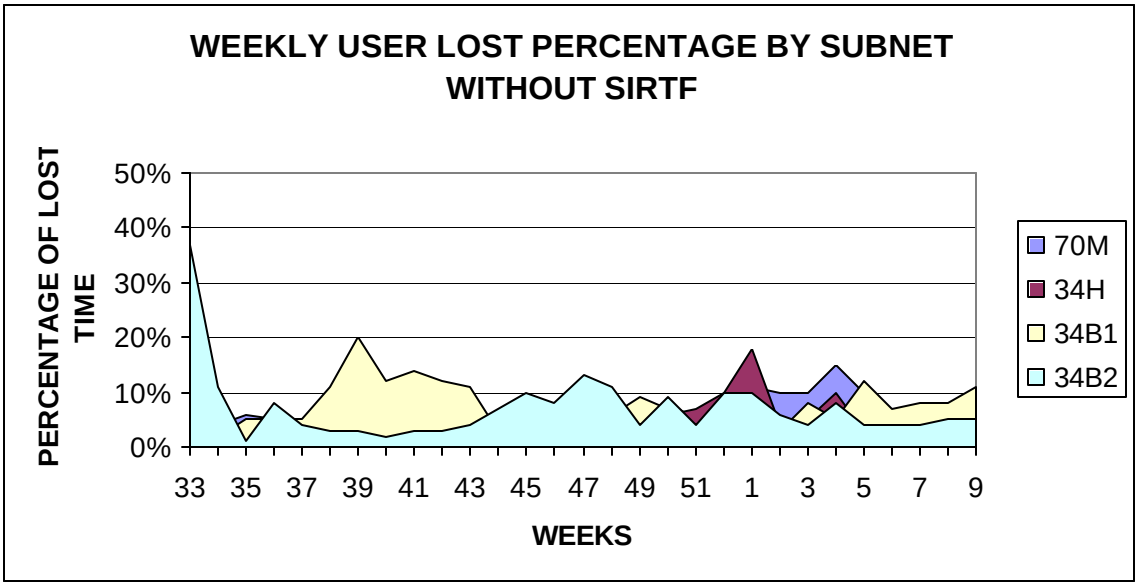



**Figure 9: WEEKLY USER LOST PERCENTAGE BY SUBNET WITHOUT SIRTF**




## Summary

This study was performed to determine the projected supportable time SIRTF may expect to receive utilizing the 34BWG1, 34BWG2, 34HEF, or 70M Subnets for launch and IOC in August 2003 through February 2004. During this period of time, a

number of significant events are planned including major DSN downtimes. Three antennas are approved and scheduled downtime for engineering upgrades. DSN antenna downtimes for DSS-54 and DSS-25 have little or no impact on SIRTF launch as other DSN antennas can provide support. If SIRTF launch occurs in week 34, DSS-46 will not presently be available to provide initial acquisition support. DSS-46 is scheduled for approved downtime for HVAC maintenance. Mars missions have planned significant events occurring throughout this period, Stardust has an encounter, and Cassini GWE is planned for October and November that impacts SIRTF's continuous support.

SIRTF can expect to receive approximately 50 to 95 percent of their requested support for launch and IOC in week 33 of 2003 through week 09 of 2004. However, the support varies by subnet and by week and cannot support 90-days of continuous coverage. If SIRTF launch occurs in August 2003 the amount of continuous support ranges from 60 to 98 percent on the 34BWG1, 34HEF, and 70M. The supportable time provided on the 34BWG Subnet ranges from 65 to 100 percent. The 34BWG2 can only provide one to two supports per day during this time period from Goldstone and Madrid. It is projected from the data presented in this study that SIRTF cannot receive 90-days of continuous coverage within the August to February time period.

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